
DEPARTMENT OF THE INTERIOR

U.S. GEOLOGICAL SURVEY

REPORT TO CONGRESS

ON PROGRAM ALTERNATIVES

FOR THE

EROS DATA CENTER

May 26, 1988

INTRODUCTION

In the portion of the Conference Report on the fiscal year (FY) 1988 Continuing Resolution covering the Department of the Interior, the Congress requested a report, to be provided by May 1, 1988, on program alternatives for the EROS Data Center (EDC), an organization within the National Mapping Division (NMD) of the U.S. Geological Survey (USGS). This report has been prepared in response to that request.

In April 1987, the Director of the USGS requested an internal program review to recommend the future mission and responsibilities of EDC. At that time, EDC was faced with the possibility of severe budget reductions because the NOAA request for FY 1988 contained no funding for Landsat operations, a significant source of EDC funds, and due to the general reduction requested in the FY 1988 USGS budget. As the review was in progress, the immediate funding problem was solved for FY 1988 by a supplemental appropriation for the National Oceanic and Atmospheric Administration (NOAA) for Landsat operations from which funding was transferred to the USGS; however, a similar problem exists for FY 1989, and is expected for FY 1990.

Although the internal program review is not formally complete, much of the information and discussion in this report is derived from the activities of the program review team. The team consists of representatives from the USGS Director's Office, the divisions of the USGS, EDC, NOAA, the National Aeronautics and Space Administration (NASA), the Defense Mapping Agency (DMA), and is chaired by the USGS Assistant Director for Programs. The team has conducted interviews and held discussions with numerous officials and scientists from the Department of the Interior bureaus, NOAA, NASA, USGS and the Department of Defense (DOD) agencies, and others. The purpose of the discussions was to review the activities of EDC and ascertain their value to those organizations making use of its products and services.

BACKGROUND

The Department of the Interior established the Earth Resources Observation System (EROS) program in 1966 and placed management responsibility for the program in the USGS. The EROS Data Center was established in Sioux Falls, South Dakota, in 1971 to archive and distribute NASA land remote sensing satellite data and for applications development and training associated with Department of the Interior use of remotely sensed data. The present facilities outside Sioux Falls were completed in 1973. Under a 20-year lease-purchase agreement, the USGS will gain full ownership of the facility in 1993. In 1983, EDC was assigned organizationally to the USGS National Mapping Division and is now a major field center of that division.

Also in 1983, responsibility for the Landsat program was transferred to NOAA. \$2.4 million in USGS appropriations previously used to support EDC Landsat activities and \$2.9 million in Landsat product sales revenues were transferred to NOAA, and NOAA began funding EDC Landsat functions.

Under the provisions of the Land Remote Sensing Commercialization Act of 1984 (P.L. 98-365) EDC has been receiving funds from NOAA to maintain, reproduce, and distribute Landsat data for EOSAT, the commercial operator of the Landsat system. In 1986 the USGS and NOAA signed Memoranda of Understanding (MOU)

covering establishment at EDC of a National Satellite Land Remote Sensing Data Archive, called for by P.L. 98-365, and associated Federal research activities.

On March 16, 1988, USGS and NASA signed an MOU covering use of EDC for processing, distributing, and archiving land remote sensing data acquired by NASA's research and development and experimental activities, including the Earth Observing System (EOS) component of the Space Station Polar Platform projected to be operational by the mid-1990's. Implementation plans are now under development.

The current range of programs at EDC is significantly broader than in 1971. EDC accessions, archives, and distributes aircraft and civil satellite land remote sensing data, and provides analytical services to a wide variety of data users. Scientists and technicians at EDC carry out a broad program of research and development of advanced information systems employing remote sensing, cartographic, and digital earth science data.

EDC has continued to expand reimbursable support of Federal agencies in remote sensing and Geographic Information Systems (GIS) products, services, and research.

PRESENT SITUATION

Current Staffing and Funding Situation of the EROS Data Center

At the present time, personnel strength at EDC is about 50 Federal employees and about 260 contract employees. The mix of Federal and contract employees allows EDC to react with some degree of flexibility in responding to project needs, changes in priorities, and funding uncertainties.

Funding for EDC for Fiscal Year 1987, estimated for Fiscal Year 1988, and proposed possibilities for Fiscal Year 1989 and Fiscal Year 1990 is as follows (in millions):

	FY 1987	FY 1988	FY 1989 (prop.)	FY 1990 (prop.)
USGS	\$ 8.4	\$ 7.8	\$7.1 - 8.6 (?)	\$7.1 - 8.6 (?)
Data Sales	1.5	1.7	1.6 - 1.8 (?)	1.7 - 1.9 (?)
NOAA	6.7	5.2	0.0 - 2.0 (?)	0.0 - 2.0 (?)
Other Agencies	<u>1.1</u>	<u>1.8</u>	<u>2.3 - 2.5 (?)</u>	<u>2.5 - 3.0 (?)</u>
Total	\$17.7	\$16.5	\$11.0 - 14.9 (?)	\$11.3 - 15.5 (?)

Note: The table does not include potential funding for activities discussed later in this report for the National Satellite Land Remote Sensing Data Archive, NASA's Earth Observing System, or the Federal global change program.

Current Data Holdings and Sales

Currently, EDC has holdings of over 8 million frames of aerial and space photography in its archive, as well as 100,000 magnetic tapes of digital remote

sensing, cartographic, and earth science data. Sales of products from these holdings account for \$1.7 million in FY 1988 and are growing at 5 to 10 percent annually.

Open Issues Affecting the Future of the EROS Data Center

There are a number of issues which raise questions regarding the future of EDC. The first of these, which prompted the internal review, is funding. The budget requested for the EROS subactivity, from which EDC receives a major portion of its USGS funds, in FY 1989 is \$1.5 million less than FY 1988; from \$8.6 million down to \$7.1 million.

The NOAA budget request contains no money for Landsat operations. The EDC has continued to receive funds from this source as part of the commercialization called for in P.L. 98-365. Recently, however, Landsat operations funds have not been included in the NOAA budget request because the Landsat satellites have exceeded their design life. Therefore, money has been added to NOAA's budget through supplemental funding for operations, and a portion of that money has then been transferred to EDC. The amount available for FY 1989, if any, is presently unknown, but could range from no funding to about \$2.0 million. This is a reduction of \$3.0 million to \$5.0 million from FY 1988 to FY 1989 and will have a serious impact on EDC's ability to provide required support to the Landsat program. Therefore, the near-term financial status of EDC, in terms of maintaining its basic level of activity, is dependent on the outcome of appropriations for FY 1989 for both the USGS and NOAA.

A second significant unresolved issue is the status of the National Satellite Land Remote Sensing Data Archive called for in P.L. 98-365. The Act gave the responsibility for the archive to the Secretary of Commerce, but no funds have been appropriated so far. Some of the funding transferred by NOAA to EDC each year in support of Landsat data reproduction and distribution has been used for archive-related activities. NOAA has indicated a willingness to transfer the responsibility for the archive to Interior through amendment to the Act, but without the necessary funding, because Landsat operations funding is not part of NOAA's base.

Officials from both NOAA and NASA have expressed agreement on the necessity for the archive, and have stated their belief that it is appropriate for the archive to be located at EDC, since EDC already provides that service.

The current estimate to fund fully and operate the archive consistent with the requirements of P.L. 98-365 to preserve the data for future scientific use is \$4.0 million per year in the initial years. This figure could decrease in the outyears following initial systems implementation. The cost to acquire desired data from EOSAT and other commercial sources in order to complete and continue the basic data sets for the archive is estimated to be as much as \$8.0 million per year. At present both the archive and data acquisition for the archive represent an unfunded obligation under P.L. 98-365.

It is anticipated that a General Accounting Office review of United States and international plans and activities associated with archiving environmental satellite data, scheduled for completion in summer 1988, will be of use in further evaluating and resolving the archive issue.

Also pending is USGS's role in participation with NASA in activities related to NASA's experimental remote sensing program, including the Earth Observing System (EOS).

This issue is in the early stages of discussion and negotiation, and has the potential for significant future funding and activity for EDC. It is worthy of brief discussion in this report. Consistent with the NASA/USGS MOU signed March 16, 1988, NASA has proposed a short-term role in which EDC would archive NASA aircraft and shuttle data, including Airborne Visible and Infrared Imaging Spectrometer (AVIRIS), Thermal Infrared Multi-spectral Scanner (TIMS), and Synthetic Aperture Radar (SAR) aircraft data. Such activities would provide beneficial interaction and experience in preparation for handling similar EOS data later in the mid-1990's.

In addition, the implementation negotiations and plan resulting from the MOU will outline the USGS and EDC role in EOS, which is to be flown in conjunction with the NASA Earth Orbiting Space Station. Current preliminary discussions indicate that EDC activities could double by FY 1995 because of EOS-related efforts. Equipment to support EOS operations, purchased by NASA for EDC during FY 1993-1994, in order for the program to be up and running by FY 1995, could total \$40.0 to \$50.0 million. The EOS sensors will work at very high data rates and the resulting large volumes of land remote sensing data will require extensive processing and archiving capabilities. The USGS will have a significant role in assisting NASA in the design of the sensors needed for gathering the basic earth science data sets. In addition to the equipment, potential exists for significant funding to support EOS operations at EDC.

It should be emphasized that the NASA-related activities discussed above represent significant potential for funding, but are dependent on the future of EOS as it is developed in the scientific and budgetary climates of the next few years.

An issue with broad implications, and related to a number of the other issues, is the future role of EDC in the developing Federal global change program. Potential exists for EDC to have significant involvement in research and development of data base structures for the management, exchange, and analysis of large quantities of earth observation data. Data will originate with the various agencies, with differing technical expertise. It will be stored in formats that can be retrieved and interpreted by others, and exchanged or used over long distances by scientists in many organizations worldwide. Landsat archival data, USGS earth-science data sets, EOS data, and global circulation models are examples of data that may be used in the program. Initial estimates suggest funding of \$2.0 million possibly as early as FY 1990 for data base design by the USGS in support of the program.

The final remaining issue is the level of involvement of other agencies including bureaus of the Interior Department, the DOD agencies, the Central Intelligence Agency (CIA), the Agency for International Development (AID), and the Department of Agriculture (USDA), among others with activities at EDC in terms of participation and funding.

OPTIONS FOR THE EROS DATA CENTER

Three principal options were considered for the future of EDC. These are derived from analysis of the current and potential future situations and the findings of the internal review. These options are

- o Close the EROS Data Center,
- o Cover the funding needs of the EROS Data Center from within the current USGS budget, or

- o Establish and implement a well-defined multiagency activity in remote sensing and earth science data archiving, data management, research, and data analysis, with EDC as an integral core participant.

CONCLUSIONS ON OPTIONS

Close the EROS Data Center

Although closing EDC is an option that must be considered, it is not a preferred option. EDC is a modern physical facility, equipped with state-of-the-art hardware, and it maintains a talented work force. Because of the nature of the contract work force and the equipment resident at EDC, management has considerable flexibility in responding to changes in technology and priority of the work to be done, as well as in responding to the needs of a wide variety of customers.

The services and products of EDC are valuable to the USGS and other organizations, especially field level offices of the bureaus of the Department of the Interior with land or resource management responsibilities. The program review team heard many representatives from USGS and the other offices state that they anticipate making continuing use of the capabilities of EDC. One of the most frequently heard comments was that it would be prohibitively expensive and duplicative for those organizations to establish in-house capability comparable to EDC. In some cases, in fact, representatives of the organizations believed they would likely be forced to do without such capabilities altogether, rather than make a significant investment of their own resources.

As stated previously, representatives from NASA and NOAA believe there is need for a remote sensing data archive, and that it should be continued at EDC.

Finally, it is recognized that it would be politically difficult to propose the closing of EDC because of its importance to the State of South Dakota.

Cover the funding needs of EDC from within the current USGS budget

Although fully covering EDC funding needs from within the current USGS budget is an option to be considered, it is not a preferred option for the bureau. Complete funding would call for redirection of funds from other programs within the USGS which have been reduced in the recent past or have been proposed for reductions to meet deficit reduction targets. Financial support required from other programs would create management problems.

Further, the current activities of EDC, while considered important by a number of organizations, are not all directly supportive of USGS programs, and would not be, nor should they be, the highest priority for the USGS.

Establish and implement a well-defined multiagency activity in remote sensing and earth science data archiving, data management, research, and data analysis, with EDC as an integral core participant.

This activity, the components of which are described in the following section of this report, is the most reasonable and rational of the three options under

consideration, and is the preferred option. It would provide the most benefit to the Federal government by providing the required support to those organizations involved in remote sensing and earth science activities. Under this activity, the technological evolution of EDC would continue and its value to USGS and other clientele organizations would increase. EDC's support for the programs of the USGS and other organizations, such as the land and resource management bureaus of the Department of the Interior, would continue.

In order to implement the multiagency activity a number of organizations (including Department of the Interior, Department of Commerce, NOAA, NASA, DOD, AID, and other clientele organizations) would be required to make a concerted and coordinated effort. The activity would have to be carefully developed to receive the support of the Administration and the Congress. Inherent and basic to its development is solving the data archive funding issue remaining from P.L. 98-365.

COMPONENTS OF A MULTIAGENCY ACTIVITY

The EROS Data Center already houses the basic activities that are the essential component of a multiagency activity. The program review has reaffirmed the value of EDC to many organizations. Closing EDC would either result in organizations losing capability in land remote sensing or spatial data analysis, or force them to develop their own in house capacity to perform the work now done in cooperation with EDC. Either of these results would not be in the best interest of the Federal government in terms of overall Federal monies invested, and would be less effective as well.

The multiagency activity, involving the support and participation of many different organizations, would build upon current EDC activities and capabilities. In general, these activities would include information systems research and development, applications development, data management, archiving, product generation, and analytical services for remote sensing, GIS, earth science, and cartographic data. EDC activities and capabilities would in part support the mission of the USGS and would be within the scope of USGS authority. The activities described below represent an evolution and enhancement of the role of EDC has had in working with the other organizations as that role has developed over the years.

U.S. Geological Survey

The following are representative of the activities at EDC that would continue to be conducted, and could be enhanced, in support of USGS programs:

- o Aerial photography archiving, distribution, & information systems support,
- o Production digitizing of selected National Digital Cartographic Data Base digital line graphs and thematic data for USGS GIS support,
- o Image processing & image mapping research & development relating to the application of satellite and digital aircraft data to USGS earth science and cartographic activities,
- o Mark II software development and systems definition support for the development of cartographic and GIS data standards,

- o Development of hydrologic applications of remote sensing and GIS techniques in cooperation with the Water Resources Division of the USGS,
- o Development of computerized analysis techniques in support of and cooperation with Geologic Division programs,
- o Archiving & distribution of USGS earth science data sets,
- o Development of prototype GIS systems.
- o Operating the Advanced Very High Resolution Radiometer (AVHRR) data receiving, processing, and analysis system at EDC for providing research products to the scientific community that are specifically related to land applications.

The estimate for USGS funding provided to EDC for core activities is about \$8 million or more per year. This level of funding would provide the basis for EDC maintaining the ability to carry out research, assess and test technological improvements in remote sensing and spatial data analysis, and provide support for basic USGS programs.

Other Department of the Interior Bureaus

The EDC has played a major role in the development, demonstration, coordination, and integration of remote sensing techniques and applications in the bureaus of the Department of the Interior. It is expected that EDC will continue to be the principal remote sensing facility and focal point for spatial data handling and processing for the bureaus of the Department.

Reimbursable revenue from work conducted in support of DOI bureaus is estimated at about \$500,000 in FY 1990 and would likely remain relatively constant.

National Oceanic and Atmospheric Administration

The EDC would continue to work with NOAA and provide support for a number of cooperative activities. These may include the following:

- o Support for Landsat 4 and 5 (MSS and TM) data archiving, product generation and distribution during transition to full commercial operations of the Landsat 6 system. The possibility exists that EDC could continue to fill customer orders for Landsat MSS data products after the demise of Landsat 4 and 5, if all three parties, NOAA, USGS, and EOSAT, reach agreement on terms for such services.
- o The National Satellite Land Remote Sensing Data Archive could be established at EDC as covered by the 1986 MOU between NOAA and USGS in response to the 1984 Act. The archive would be a repository for basic ongoing land remote sensing data sets. The estimate for operating a fully funded archive is approximately \$4.0 million annually. The issue is how to fund this activity in times of constrained budgets.
- o Participation in the Cooperative Land Remote Sensing Research Program at EDC established by MOU between NOAA and USGS in 1986. Since 1986,

NOAA has located one research scientist at EDC to participate in the program. The Soil Conservation Service joined the program in 1988 with one scientist, and there is potential for additional growth. The 1984 Act encourages Federal agencies to cooperate in remote sensing research programs.

In FY 1988, NOAA provided \$5.2 million to USGS for EDC support for Landsat 4 and 5 data handling, product generation, and archiving. Landsat 4 and 5 support currently is funded through requests for supplemental appropriations. If the existing Landsat system continues to operate into 1989, EDC most likely will receive support consistent with its approved level of effort and available funds in FY 1989.

National Aeronautics and Space Administration

A major initiative is under discussion with NASA which has the potential for providing significant funding, mostly in out years, for joint activities with EDC. This initiative involves cooperation in the design, development, and operation of the EOS data and information system.

Possibly beginning as early as FY 1990, although more likely later, there is a potential for NASA providing support at a level between \$1 and \$2 million for development activities and handling of experimental aircraft and shuttle data leading to EOS in the mid-1990's. The land data elements of EOS activities may involve funding of \$40 to \$50 million in equipment to be placed at EDC and annual operations of as much as \$15 to \$20 million starting in FY 1994-1995.

Agency for International Development/Department of State

International development and assistance agencies have expressed a need for timely and accurate geographic and cartographic information describing the location, condition, and extent of resource assets, so that problems such as food shortages, drought, deforestation, and the like, can be rapidly assessed, remedial actions better managed, and development programs defined. EDC has and will continue to provide technical assistance in remote sensing and GIS applications for resource assessment and monitoring in less developed regions and countries at the request of these agencies. The ultimate goal is to make the tools and techniques useful to the nations involved and to transfer them to those nations or to regional centers.

These activities are fully reimbursed by AID and other donor organizations. Funding is projected at about \$1.2 million in FY 1990 and has the potential to grow to about \$2 million in the future.

Department of Defense and Intelligence Community

EDC has the capability to provide assistance to the Defense and intelligence community for exploitation of civil land remote sensing satellite data and GIS technology for military and intelligence purposes. A facility has been set up at EDC for use in support of these activities. Assistance includes data acquisition, data cataloging and indexing, data processing, software development, product generation, data analysis, applications development, research and development, and training and technology transfer.

Reimbursable funding for these activities for FY 1988 is expected to be about \$750,000 and is estimated as being potentially higher in the future.

Other Federal Agencies

The approach to providing customer products, software services, and general support in remote sensing and GIS applications to other Federal agencies, such as agencies in the Department of Agriculture (Agricultural Research Service, Soil Conservation Service, and Forest Service) is and would continue to be based on assessment of the mutual benefit to USGS and the other agency, the size and scope of the request and the resources available, and the potential for success. Requests would be considered on a case-by-case basis. Reimbursable revenue from these sources is expected in FY 1990 to be about \$500,000 and may grow to about \$1 million in the future.

Private Sector/Commercial Support to EDC

The EDC could receive support from private industry for certain activities conducted at EDC and making use of EDC facilities. Some examples follow:

- o EDC support for the Landsat program during transition to full commercial operation while Landsat 4 and 5 are operating beyond their original design lifetime. In this time period, NOAA is funding this extended period of operations through supplemental appropriations. Should the Congress not provide sufficient funds to continue full EDC support, NOAA could attempt to negotiate with EOSAT to use a percentage of their revenues, presently received by EDC and passed along to EOSAT, to offset this shortfall.
- o EDC support for the Landsat program after the demise of the Landsat 4 and 5 system and during the period (1991-1996) that EOSAT is operating the Landsat 6 system. EOSAT will continue to have the exclusive right to market Landsat 1-5 MSS data during the lifetime of Landsat 6. To the extent that there is demand for these data, EOSAT may find it cost-effective to reimburse EDC for responding to requests for MSS data products under terms negotiated among NOAA, USGS, and EOSAT.
- o The participation of industry in its cooperative research programs, such as contemplated by the NOAA-USGS Cooperative Land Remote Sensing Research Program.

CONCLUSION

In summary, the USGS and the EROS Data Center are faced with a number of issues affecting EDC's future. These issues, in brief, include the \$1.5 million reduction from FY 1988 to FY 1989 in the budget request for the EROS subactivity; the level of Landsat operation funding to be transferred from NOAA to EDC for FY 1989; responsibility and funding for the National Satellite Land Remote Sensing Data Archive; USGS participation in NASA's Earth Observing Systems initiative; involvement of other agencies with activities at EDC; and EDC's role in the Federal global change program. The resolution of these issues is dependent on the involvement and support of other organizations.

The USGS intends to work with the other agencies to develop and enhance the multiagency activity that was described above. It would ensure EDC's continued utility and viability, but will require careful coordination between those agencies, within the Administration, and with the Congress.